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FOREST PEST MANAGEMENT
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AN EVALUATION OF INSECT AND DISEASE CONDITIONS IN MIXED CONIFER STANDS UNDERBURNED FOR FUELS REDUCTION ON THE QUINCY RANGER DISTRICT, PLUMAS NATIONAL FOREST

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ABSTRACT

Several mixed conifer stands underburned for fuel reduction were examined for pest damage. Direct mortality from a combination of fire injury and pests was infrequent, but the red turpentine beetle was commonly found attacking the bases of scorched ponderosa pine, and there is some potential in 1983 for increased attacks by other bark beetles, including the western pine beetle. Fire wounds on white fir, especially those in contact with the ground, will probably provide entry points for decay fungi and some loss will likely occur. The need for additional information on the overall effects of underburning in mixed conifer stands is discussed.

INTRODUCTION

At the request of Robert Wilcox, District Ranger, Quincy Ranger District, John Pronos and John Wenz of the Forest Pest Management Staff met on August 3, 1982 with Bob Reitman and Joe Davis of the Quincy District and examined several mixed conifer stands in the Taylor Creek - Greenhorn area that had been underburned in late-April, 1982. They were accompanied by Phil Weatherspoon and Jerry Reid of the Pacific Southwest Forest and Range Experiment Station - Silvicultural Unit in Redding. Bob Wilcox met with the group in the afternoon while in the Greenhorn area.

In the spring of 1982, the Quincy District underburned 383 acres of mixed conifer stands for fuels reduction and are planning to burn considerably more in the future. This request for an insect and disease evaluation is part of the general post-burn evaluation designed to

analyze overall results of the project. The objectives of this insect and disease biological evaluation were to 1) identify insect and disease problems in the underburned stands and determine which ones were associated with, or caused by, the underburning, 2) provide management alternatives to prevent or mitigate the identified problems, particularly with reference to future underburning projects, and 3) provide information for use in making decisions concerning the future use of underburning as a management tool for fuels reduction in mixed conifer stands.

OBSERVATIONS AND DISCUSSION

The underburned stands examined were of the mixed conifer type, mainly composed of ponderosa pine, white fir and Douglas-fir with lesser amounts of incense cedar and sugar pine. The stands were 60-80 year old small- to mid-sized sawtimber with a pole-size understory. Site was generally a Dunning II or III. Several stands in the Greenwood area were being precommercially thinned by implementing a "commercial" ($5/cord) fuel wood sale that also removed solid slash down to 3 inches. These operations utilized leave-tree marking and reduced basal areas from 400+ sq.ft./ac to about 140 sq.ft./ac. The basic management objective for the areas examined is to maintain a mixed conifer stand, with ponderosa pine and white fir as the primary species, for optimum sustained yield timber production subject to multiple-use contraints. The following discussion is restricted to insect and disease related observations; the District is evaluating other fire-related effects - e.g., fuels reduction and residual-tree mortality levels.

Insects

The most evident insect situation encountered, three months after the underburnings were completed, involved the red turpentine beetle, Dendroctonus valens (Dv), which was found attacking numerous ponderosa pines in all areas examined. Most of the attacks, as evidenced by pitch tubes and reddish boring dust, were located in the basal three to four feet of the bole; few attacks were found above 4-5 ft. and several were located at ground line. Copious pitch flow occurred around many of the attacks. Most of the attacked trees examined had incipient or short egg galleries, often with large amounts of resin, indicating either that gallery construction was still in the early stages or that the attacks were unsuccessful. Red turpentine beetle eggs were observed in only two of the attacked trees examined. There was no obvious correlation between the degree/severity of bark scorch or other manifestations of fire injury and Dv attack.

The incidence of Dv attacks was relatively high in a stand in the Greenhorn area. In addition to having a high proportion of small- to mid-sized sawlog ponderosa pine, this particular stand was adjacent to a stand that had been thinned the year before (1981) as part of the District's fuelwood contract program. Many of the resulting stumps in the thinned stand had been attacked by Dv. Also, the stand was approximately two miles from an 800-acre wildfire that burned in 1981 and which, according to District personnel, had numerous Dv attacks in

burned trees and stumps. Although Dv is native to the area and certainly occurs naturally in the stands, the concentration of Dv in both the wildfire and thinned areas may have contributed to the relatively high incidence of Dv in the nearby stands underburned in 1982.

No western pine beetle, Dendroctonus brevicomis (Db), group kills and very few individual green trees currently under attack (some fresh pitch tubes on bole) were found in the stands examined. However, this is not necessarily indicative of the potential for future Db related problems in underburned stands. In contrast to the red turpentine beetle, increases in western pine beetle-attacked trees in burned (both wild and prescribed) areas have not been observed very soon after the occurrence of the fire. This implies that heat and/or odors present in smoke produced from burning pine foliage and/or resins are attractive to Dv adults, but not to adults of the western pine beetle. An increase in Db attacks has been observed, however, in the fall following a spring burn and in the late spring or early summer of the year following the burn. Thus, there is some potential for Db attacks in the underburned stands from about September-October of 1982 and from mid-May to mid-July of 1983.

The frequency of successful western pine beetle attacks is related to the degree that the trees remaining after the burn are damaged/weakened. Two factors, amount of crown defoliation from fire and to a lesser extent, amount of cambium injury, have been shown to be related to Db attacks and subsequent mortality. The greater the amount of defoliation by fire, particularly above 50%, the greater the probability of being killed by Db. The probability of mortalilty is enhanced somewhat if the heavily defoliated trees also have injured cambium, but the effect of injured cambium is much less on lightly defoliated trees. There have also been observations that fire damage to the cambium in the root collar region increases the probability of attack by Db. Thus, the post-burn evaluation being conducted by the District, to the extent that it determines the number of ponderosa pines with the above fire-related injuries may give an indication of the potential for western pine beetle damage. Attacks by the red turpentine beetle, particularly in trees weakened by the above factors, may increase the susceptibility of the trees to Db attack. The effects may also be more severe if environmental stress occurs, like sub-normal winter precipitation resulting in unusual moisture stress the following growing season.

One sugar pine was found in a Greenhorn fuelwood-thinned stand infested with the mountain pine beetle, D. ponderosae (Dp). The mountain pine beetle can attack trees immediately after a burn. In mixed conifer stands in California, Dp is competing with the western pine beetle for suitable ponderosa pine hosts and has generally not been as successful as Db. Its potential to attack sugar pine remaining in the underburned stands is probably influenced by factors similar to those discussed above for Db - ponderosa pine.

There was little evidence of the fir engraver, Scolytus ventralis (Sv)in white fir at this time. There is little information available concerning Sv-related damage in underburned true fir.

Diseases

Disease problems resulting from underburning were not evident at the time of this field examination. The primary concern, however, is that decay fungi may enter into fire-damaged trees and eventually cause loss of merchantable wood. Decay loss would probably be restricted to, or greatest in, white fir, and it would take several years before any loss would be evident.

The results of a recently completed, but as yet unpublished, study in California indicate that true firs are very susceptible to decay following logging or mechanical injury. Heartrots have been historically considered a problem of old-growth trees, but this work shows that young second-growth fir begins to decay immediately after being damaged, and the merchantable volume of lost wood averages about 1% per year. The study included logging injuries between 1 and 13 years old.

The question is how fire injuries to fir compare with open mechanical wounds as far as providing entry points for decay fungi. Logging injuries in contact with the soil almost invariably become colonized by decay organisms. Fire wounds are often worst at ground line. The most severe wounds observed during this evaluation occurred when burning slash was in direct contact with tree boles. The difference between these two types of wounds is that fire wounds from controlled burns are not usually open; normally some charred bark (or at least some charred wood) is left covering the dead cambium and sapwood. This burnt material would probably delay the entry of fungi but would also prevent the wood underneath from drying out, especially at or below the soil line. For this reason we feel that fire wounds in contact with the ground are just as likely, if not more so, to result in heartrot as are open mechanical wounds. The resulting decay loss would be similar.

We did see long, narrow strips of fire- or heat-killed cambium that followed bark crevices and extended up to heights of about 8 feet. These injuries are not likely to provide good entry points for decay fungi. The bark was usually intact and the dead cambium should callus over fairly rapidly.

CONCLUSIONS

The information currently available is insufficient to reliably predict Insect and disease impacts following controlled underburns in California forests. In general, much of the potential for decay in white fir could be avoided by reducing contact between burning slash and other fuels and the desired "leave" trees. To the extent that such fire-caused injury functions as a factor that predisposes trees to bark beetle attack, avoiding or minimizing such damage should also reduce the potential for subsequent damage by bark beetles, particularly the western pine beetle. Conifers are usually more resistant to fire damage in the fall and, because the chances of attack by Dv decrease with the onset of cooler temperatures, burning in late fall should reduce the potential for red turpentine beetle attack.

However, additional information is needed before adequate estimates can be provided for the potential of insect- and disease-related damage/impact following prescribed burning for fuels reduction in mixed conifer stands. Such information includes determining the relationship between fire wound size, location and severity and the amount of resulting decay. In addition, the rate and amount of decay after white fir is damaged should be verified. Also, the amount and subsequent effects of red turpentine beetle attack should be determined, as should the amount of subsequent mortality (and associated site/stand/tree conditions) due to other bark beetles, e.g., western and mountain pine beetles, pine and fir engravers.

Until adequate information becomes available, the District should continue to closely monitor the areas already burned. Results of this monitoring effort and the general lack of reliable information concerning the overall effects of underburning in mixed conifer stands in California should be considered when planning the number of acres to be so treated in the immediate future.